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RESEARCH ARTICLE

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Contribution to the floristic knowledge of the Maddalena Mountains (Basilicata and Campania, southern Italy)

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Abstract

The inventory of the taxa collected during the annual field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society is reported. It was held in 2013 along the Maddalena Mountains, a mountain ridge of the southern Apennines located between the Basilicata and Campania administrative regions (southern Italy), considered as being poorly characterized in terms of vascular flora. A total of 701 units belonging to 74 plant families were recorded including two varieties and four hybrids.

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Thirty-five taxa resulted endemic to Italy and only 11 alien species were detected, while 36 taxa are new or confirmed for the regional floras of Basilicata and/or Campania. In particular, 12 taxa are new for Basilicata, while four are confirmed. Regarding Campania, 14 taxa resulted new for the regional flora and five were confirmed.

Keywords
New floristic records, regional flora, southern Apennines, vascular flora

Introduction

In recent years, the working group for Floristics, Systematics and Evolution of the Italian Botanical Society has been very active in increasing the knowledge about the vascular flora of poorly known areas. Specifically, several contributions have been published regarding southern Italy (e.g. Bernardo et al. 2012, Wagensommer et al. 2014, Domina et al. 2015), as the result of the annual field trip organized by the group. Two of these contributions were focused on Basilicata (Conti et al. 2006, 2007b) and one on Campania region (Santangelo et al. 2010).

The selection of the areas to be investigated has been mostly addressed to fill the gaps pointed out by Scoppola and Blasi (2005) or by others regional or national projects, as the mapping of Important Plant Areas (Blasi et al. 2011).

In this paper, we present the results of the field trip held in 2013 in the southern Apennines and organized by the botanists of the University of Basilicata (L. Rosati, S. Fascetti and V.A. Romano), aimed at increasing our floristic knowledge of the western border between the Italian administrative regions of Basilicata and Campania.

Study area

The investigated area includes the central part of the Maddalena Mountains and some neighbouring biotopes of particular interest for vascular plants (Suppl. material 1: 1).

The Maddalena Mountains are a carbonatic ridge, aligned from NNW to SSE and extending for 40 km. They are located between the intramountain basins of the Val d'Agri (Basilicata) to the east and the Vallo di Diano (Campania) to the west. The altitude ranges from 300 m a.s.l. at the bottom of Melandro Valley, to 1503 m a.s.l. at the top of Serra Longa.

This sector of the southern Apennines is characterized by a remarkable geological complexity, mainly due to the effects of a translational tectonic that placed the formations of the Mesozoic carbonatic platform on the silico-clastic Lagonegrese Units. The Holocenic detritus represents the connection with the recent alluvial deposits of the main valleys due to tectonic morpho-structures shaped like a "graben" (Grimaldi and Summa 2005).

The morpho-structure of the Maddalena Mountains is less affected by karst phenomena than other massifs of southern Italy; however, karstification is well developed in those areas where Cretaceous limestones prevail on Triassic dolomites (Celico 1979). Several tec-

tonic-karst basins (Mandrano, Mandranello, Magorno etc.) that are periodically flooded during the winter-spring season and are dotted with numerous sinkholes can be observed; they correspond to graben or contacts between lithotypes with different permeabilities.

Rainfall in the area is concentrated in the autumn-winter period, with a maximum in November-December and a minimum in summer (July-August); a summer drought of two to three months also occurs (Suppl. material 1: 2). Annual average temperature ranges from 12.5 to 14.7 °C, with the hottest months in summer (July-August) and the coldest in winter (January-February).

According to the classification proposed by Rivas-Martinez et al. (2011), a dominant Mediterranean pluviseasonal oceanic-semicontinental macrobioclimate can be recognized in the hilly and submontane belt (ranging from the lower humid mesomediterranean to humid supramediterranean phytoclimatic belt). However, local factors (increasing altitude, northern slopes) influence the shift towards the oceanic humid supratemperate belt.

The Maddalena Mountains are partially included within the Appennino Lucano National Park and within two Natura 2000 sites: "Monti della Maddalena" (code IT8050034) and "Faggeta di Moliterno" (code IT9210110). Nevertheless, this territory has never been the object of specific botanical contributions, except for the biotope "Faggeta di Moliterno" located in the southern part of the ridge (Fascetti et al. 2013). Other information concerning the vascular flora of this sector is available for the adjacent areas of the Lucanian Apennines (e.g. Gavioli 1948) or for the Cilento, Vallo di Diano and Alburni National Park (e.g. Moggi 2002, Rosati et al. 2010, 2012 and references therein).

Materials and methods

To maximize vascular flora sampling, 12 sites were selected as representative of the local diversity in terms of climate, litho-morphology, and land use (Suppl. material 1: 3). They were intensively sampled during the period 5–8 June, 2013 by 24 participants (Suppl. material 1: 4). The floristic list followed the same methodology as in previous contributions (e.g. Conti et al. 2006, Peccenini et al. 2010, Peruzzi et al. 2011).

The work was coordinated and the floristic list drawn up by the organizers with the contribution of all participants to the excursion. A revision of the samples collected during the field work was carried out at the University of Roma Tre (27–28 February, 2014), followed by specific studies and comparisons of unidentified taxa. Some critical samples were sent to specialists for determination: *Viola* (A. Scoppola, Viterbo), *Orobanche* (G. Domina, Palermo), ferns (D. Marchetti, Massa).

Nomenclature and taxa delimitation followed the updated version of the Checklist of Italian Flora (Bartolucci et al. 2016, Galasso et al. 2016), which is currently in the final stage of drafting, except for varieties (not considered in the Italian Checklist) and some hybrids (for further details see the notes in Suppl. material 1: 6). For the Orchidaceae, we followed Hertel and Presser (2015) and GIROS (2016), whereas for the genus *Rosa* we referred to Klastersky (1968).

For each unit at least one herbarium specimen was prepared and preserved in public or private herbaria listed in Suppl. material 1: 5.

The floristic list (Suppl. material 1: 6) was sorted in a linear sequence of families according to PPG I (2016), Christenhusz et al. (2011) and APG IV (2016) and taxa were ordered alphabetically. Synonyms are indicated in square brackets only in the case of changes that have occurred from the last version of the Italian Checklist of vascular flora (Conti et al. 2005, 2007a).

For each unit, we reported locations of collection, using the abbreviations given in Suppl. material 1: 3, and the prevailing environments of growth. The herbaria where samples are stored (acronyms for official herbaria according to Thiers 2016) are reported in brackets. The floristic novelties for the regional flora are marked with asterisks in Supplementary data (* = confirmed taxon, ** = taxon new for the regional flora, BAS = Basilicata; CAM = Campania). The letters "E" and "A" preceding the scientific names of the taxa indicate endemic and alien taxa, respectively.

Results

In total, more than 2600 samples of vascular plants were collected, belonging to 701 taxa and 74 families (see the complete floristic list in the Suppl. material 1: 1), including two varieties (*Ophrys apifera* Huds var. *bicolor* (Nägeli) E.Nelson and *Salvia officinalis* L. var. *angustifolia* Ten.) and four hybrids (*Acer* ×*coriaceum* Bosc ex Tausch., *Anacamptis morio* (L.) R.M.Bateman, Pridgeon & M.W.Chase × *A. laxiflora* (Lam.) R.M.Bateman, Pridgeon & M.W.Chase, *Crataegus* ×*media* Bechst. nothovar. *sicula* (K.Koch) K.I.Chr., and *Thymus longicaulis* C.Presl × *Thymus striatus* Vahl).

Thirty-five *taxa* are considered endemic to Italy (Peruzzi et al. 2014) and, amongst these, the following are restricted to southern Italy:

- *Achillea rupestris* Huter, Porta & Rigo subsp. *calcarea* (Huter, Porta & Rigo) Greuter
- *Alyssum diffusum* Ten. subsp. *calabricum* Španiel, Marhold, N.G.Passal. & Lihová
- *Epipactis collaris* S.Hertel
- *Epipactis lucana* H.Presser, S.Hertel & V.A.Romano
- *Knautia lucana* Lacaita & Szabó
- *Koeleria lucana* Brullo, Giusso & Miniss.
- *Koeleria splendens* C.Presl
- *Lathyrus jordanii* (Ten.) Ces., Pass. & Gibelli
- *Scorzonera villosa* Scop. subsp. *columnae* (Guss.) Nyman
- *Viola aethnensis* (DC.) Strobl subsp. *splendida* (W.Becker) Merxm. & Lippert

Only 11 taxa were alien (*Agrostemma githago* L., *Centaurea cyanus*, L., *Erigeron sumatrensis* Retz., *Gladiolus italicus* Mill., *Isatis tinctoria* L. subsp. *tinctoria*, *Malus pumila* Mill., *Papaver dubium* L. subsp. *dubium*, *Petroselinum crispum* (Mill.) Fuss, *Prunus dulcis* (Mill.) D.A.Webb, *Senecio inaequidens* DC., *Veronica persica* Poir.).

Thirty-six taxa have to be considered as floristic novelties because either new or confirmed for the regional flora of Basilicata and/or Campania.

In particular, 12 resulted new for the flora of Basilicata:
- *Asparagus tenuifolius* Lam.
- *Blackstonia acuminata* (W.D.J.Koch & Ziz) Domin subsp. *aestiva* (K.Malý) Zeltner
- *Carex humilis* Leyss.
- *Colchicum lusitanum* Brot.
- *Iberis umbellata* L.
- *Jasione montana* L.
- *Koeleria splendens* C.Presl
- *Lupinus albus* L. subsp. *graecus* (Boiss. & Spruner) Franco & P.Silva
- *Rosa inodora* Fr.
- *Rosa mollis* Sm.
- *Valerianella microcarpa* Loisel.
- *Viola eugeniae* Parl. subsp. *eugeniae*

As regards the following units, the subspecific rank for Basilicata was specified:
- *Rhinanthus alectorolophus* (Scop.) Pollich subsp. *alectorolophus*
- *Silene italica* (L.) Pers. subsp. *sicula* (Ucria) Jeanm.

Four taxa were confirmed for Basilicata:
- *Cardamine amporitana* Sennen & Pau
- *Thalictrum simplex* L. subsp. *simplex*
- *Thymus moesiacus* Velen.
- *Scabiosa columbaria* L. subsp. *portae* (Huter) Hayek

Fourteen taxa resulted new for the regional flora of Campania:
- *Bromus hordeaceus* L. subsp. *pseudothominei* (P.M.Sm.) H.Scholz
- *Carex tomentosa* L.
- *Hordeum geniculatum* All.
- *Juncus tenageia* L.f. subsp. *tenageia*
- *Knautia lucana* Lacaita & Szabó
- *Koeleria lucana* Brullo, Giusso & Miniss.
- *Pilosella piloselloides* (Vill.) Soják subsp. *praealta* (Gochnat) S.Bräut. & Greuter
- *Ranunculus peltatus* Schrank subsp. *peltatus*
- *Rosa mollis* Sm.
- *Rubus incanescens* L.
- *Sanguisorba officinalis* L.
- *Scabiosa columbaria* L. subsp. *portae* (Huter) Hayek
- *Silene italica* (L.) Pers. subsp. *sicula* (Ucria) Jeanm.
- *Trifolium phleoides* Willd.

Finally, five taxa were confirmed for Campania:

- *Alisma lanceolatum* With.
- *Alopecurus aequalis* Sobol.
- *Myosotis nemorosa* Besser
- *Sabulina glaucina* (Dvořáková) Dillenb. & Kadereit
- *Vicia serratifolia* Jacq.

Conclusions

The high number of taxa surveyed in a few days and in a limited number of sampling localities undoubtedly indicates the high level of biodiversity of the Maddalena Mountains, an area that until now did not attract explorations by botanists.

The number of new or confirmed units at the regional level underlines the fact that floristic knowledge of Basilicata and Campania cannot yet be considered satisfactory, despite numerous publications produced in recent years (e.g. Azzella et al. 2014, Bernardo and Caldararo 2014, Rosati et al. 2012, 2015, Bonari et al. 2016, Roma-Marzio et al. 2016, Stinca et al. 2016, 2017). It should be emphasized that several collected units are linked to wetlands that risk to disappear or to become altered both globally and locally. Finally, the limited number of surveyed exotic species can be considered as an indicator of the favourable conservation status of the investigated territories that are characterized mostly by natural/semi-natural habitats or by traditional arable land of mountainous areas.

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Supplementary material 1

Supplementary data

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Data type: Word .doc file

Explanation note:

1. Study area. Surveyed sites are marked with red squares (for details see Suppl. material 1: 3 and 7–8).
2. Thermo-pluviometric diagram of two representative stations of Maddalena Mountains. Observation period of Moliterno station: 1923–2007; Sala Consilina: 1975–1995. Data from "Annali idrologici, Ministero dei lavori pubblici, Servizio idrografico". Solid line: average monthly values; dashed lined: average monthly maximum temperature; point-dashed line: average monthly minimum temperature.
3. Coded locality and geographical features of surveys. Coordinates are reported with decimal degrees WGS84. For detailed topographic map of each sites see Suppl. material 1: 7–8.
4. The 24 participants of the excursion of the Italian Botanical Society to the Maddalena Mountains, plus P. Scelzo, the Mayor of Brienza, (the second at the bottom from the left) during the visit to the mediaeval Caracciolo's Castle (courtesy of the Municipality of Brienza). Photo V.A. Romano.
5. Herbarium acronyms and institutions where the collected samples are stored.
6. Floristic list of taxa surveyed in the Maddalena Mountains.
7. Topographic map of surveyed sites (1–6). Floristic sampling sites are coded according to Supplementary 1 and 3; the cells grid is 1 × 1 km.
8. Topographic map of surveyed sites (7–12). Floristic sampling sites are coded according to Suppl. material 1: 1 and 3; the cells grid is 1 × 1 km.

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